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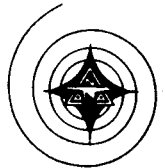
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APOLLO MONTHLY PROGRESS REPORT
(U)
NAS9-150

1 September 1963



Report Period

16 July to 15 August 1963

Exhibit I Paragraph 8.1

CLASSIFICATION CHANGE

To UNCLASSIFIED

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PROGRAM MANAGEMENT

STATUS SUMMARY

During the report period, the development testing of the pitch control equipment was concluded with three successful firings.

All development motor tests of the tower jettison motor except AD 20 and AD 21 have been successfully completed. These will require additional vibration testing to isolate the reason for the temperature rise phenomenon discovered during vibration testing of the motor. This problem will not delay the start of qualification testing, currently scheduled to start September 27.

Approval by NASA of source selection recommendation for the in-flight test device has not been received. The delivery schedule has been adversely affected by this situation.

A release from NASA to initiate procurement of the proton direction detection device has not been received.

Launch of the Little Joe II qualification test vehicle was phased ahead of boilerplate 6 pad abort test at WSMR. Little Joe II is schedule for launch during the next report period.

The first double-drogue parachute drop test was conducted at the El Centro Naval Air Facility during the report period. The drogues were deployed simultaneously and opened in a normal manner. Test performance was satisfactory.

A task force has been established to resolve the status of the changes on boilerplate 6 and to establish the most workable system for implementing changes on follow-up boilerplates and spacecraft.

Instead of using the side strakes previously considered, command module stability will be achieved through the use of aerodynamic devices mounted in the launch escape tower structure.

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CONTRACT STATUS

Negotiations have been completed with all 13 major subcontractors. Four contracts have been written, and the remaining nine contracts are either in the process of being written, approved by S&ID or NASA, or approved by the subcontractors.

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DEVELOPMENT

TECHNOLOGY

Flight Performance and Control

The lunar excursion module docking concept has been modified from an impact type to one that will permit three possible modes of operation:

1. The primary mode will employ an extendible probe that provides initial contact and latching at a separation distance large enough so that a piloting error will not cause an adverse impact. The lunar excursion module and command module will then be reeled together slowly, requiring minimum shock attenuation. Four concepts of the extendible probe are being studied (see Spacecraft and Test Vehicles, Structures, page 8).
2. The backup mode will consist of free-flying the two modules together. Mean relative impact velocities previously established during free-flying docking simulation studies (0.25 feet per second longitudinal and 0.06 feet per second lateral) will be used as the design impact velocities.
3. The emergency mode of operation will consist of crew transfer between the vehicles, while exposed to the space environment without benefit of module contact and latching operations.

A two-dimensional digital program has been developed and a three-dimensional man-in-the-loop simulation has been planned to determine the feasibility and post-contact dynamics of the primary mode. This simulation study is scheduled to begin in early October.

An evaluation study of the entry monitor display was conducted to determine the optimum display configuration for monitoring the g versus velocity trace generated during automatic entry maneuvers. The simulation program was modified to simulate automatic entry more accurately by increasing the number of automatic roll commands. In making this modification, consideration was given to the type of failures that would result in excessive accelerations forces on the crew. The monitoring method selected as a result of these investigations employs a set of rays on the acceleration versus velocity display similar to those used for exit monitoring. These rays were established by defining critical boundaries of total

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acceleration and velocity throughout the entry trajectory so that entry accelerations would not exceed 12 g's. A 3-degrees of freedom, point-mass analog simulation was used to check the adequacy of the rays. Using several tangency points on the rays as initial conditions, the maximum total acceleration obtained during analog runs was 11.6 g's. Using primary guidance trajectories, with automatic guidance failures inserted at various points to produce high g's, the maximum load obtained was 11.2 g's. No difficulty was experienced in detecting tangency conditions after primary guidance failures.

This method of monitoring high g's requires a re-set capability for the acceleration versus velocity display so that the display can be used from entry speed to about 6000 feet per second (the minimum speed at which the crew tolerance acceleration limit can be exceeded). It further requires that after initial entry the primary guidance be restricted to a maximum vehicle acceleration of 8.5 g's.

Service propulsion subsystem (SPS) propellant requirements and translunar injection weights were determined (Table 1) using a 313-second specific impulse, two combinations of command and service module weights, and design velocity changes (ΔV) (command and service module plus lunar excursion module, $\Delta V = 3883$ feet per second; and command and service module only, $\Delta V = 4801$ feet per second). No variation in command or service module weights as a function of time were assumed.

Table 1. Service Propulsion Subsystem Propellant and Injection Weight

Command Module (lb)	Service Module (lb)	Adapter (lb)	Assumed Lunar Excursion Module - Unmanned (lb)	Service Module Propellant (lb)	Translunar Injection Weight (lb)
8,500	9,500	3,000	24,460	36,145	82,005
9,500	10,500	3,400	26,500	39,841	89,741

A degree of conservatism was introduced in the assumed SPS propellant weight as a result of the constant command and service module weight assumptions. The command and service module weights actually decrease during the flight due primarily to the consumption of reaction control subsystem (RCS) propellant and the disposal overboard of excess water formed by the union of hydrogen and oxygen in the fuel cells. These time-dependent weights comprise approximately 860 pounds of the command and service module weight. The SPS propellant weights required as a result of the consideration of these variable weights are approximately 790 pounds less than those shown in Table 1.



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Thermal and Fluid Dynamics

A preliminary trade-off study of the types of heater devices to be added to the Apollo propulsion subsystems was presented to NASA-MSC during the report period. Weight increases for the heater devices, excluding thermal control units, were tentatively determined for the water-glycol, electrical, and radioisotope devices. A more detailed study will be completed during the next report period.

Theoretical SPS engine performance, using a mono-ethylhydrazine/nitrogen tetroxide ($\text{N}_2\text{O}_4/\text{MMH}$) propellant combination instead of $\text{N}_2\text{O}_4/\text{Aerzine-50}$, has been calculated and shows that a 3-second gain in total operating time may be possible. This time gain lowers the total propellant requirement, permitting a significant increase in payload. At mixture ratios of 1.6 and 2.0, calculated burning times for $\text{N}_2\text{O}_4/\text{Aerzine-50}$ were 336 and 335 seconds, respectively. These burning times were reduced only by kinetic losses. At mixture ratios of 1.8 and 2.0, the operating time for $\text{N}_2\text{O}_4/\text{MMH}$ was 338 seconds for both ratios.

Studies of the effect of propellant sloshing on propellant feed control were conducted for both the powered and the coast portions of the lunar mission. These studies show that the slosh baffles are not required during the powered portion of the mission but may be required during the coast portion.

During earth entry from a lunar mission, the outer surface of the fused silica docking windows is expected to reach a temperature of 1270 F; the side windows, 1410 F; and the hatch window, 1600 F. These temperature calculations were based on the no-strake configuration.

A thermal analysis of the flexible boot that closes out the SPS engine compartment shows the present 3/4-inch thickness of three-ply Q-felt, sandwiched between Refrasil cloth, may be reduced to a simple 1/4-inch layer provided that other critical components are insulated locally. The maximum temperatures reached by the outer and inner surfaces of such a boot are 1379 F and 646 F, respectively.

Wind tunnel heat transfer and pressure tests of a 0.05-scale command module were completed. Heating rates on the afterbody of the command module, with side strakes at a 147-degree angle of attack, were 20 times greater than without strakes. Heating rates on the side strakes were maximum in the vicinity of the strake-body junctions and decreased to approximately 50 percent of the root value at the tip.

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Tests of the 0.105-scale static force model to determine the apex cover strake configuration required to eliminate the command module secondary trim point at all Mach numbers were also completed. These tests indicated that a strake area approximately 12 square feet is required.

A 0.085-scale jet-effects model was tested in the 16-foot Langley Transonic Wind Tunnel to determine the effects of the launch escape motor exhaust plumes on the launch escape vehicle forces, pressures, and static stability. Results are being evaluated. The effects of launch escape subsystem (LES) motor exhaust impingement at altitudes greater than 100,000 feet also were determined. The exhaust plume completely envelopes the command module and the low free-stream dynamic pressure affects only the plume outer boundary. It is concluded that high-altitude jet impingement is relatively independent of angle of attack; also, the exhaust plume is highly expanded when it reaches the command module, and the maximum pressure that can be encountered is less than 10 psia.

Studies were continued of the heat dissipation problem for various electrical equipment in the event of the loss of supplemental cooling. In a depressurized cabin, with no water-glycol coolant flow, some heat dissipation occurs due to heat shorts through the aluminum and stainless steel honeycomb, insulation, and stringers, all of which conduct heat to an external radiating surface. Results, however, show a trend to excessively high temperatures for some electrical equipment. Modifications to the existing equipment duty cycles such as intermittent operation of equipment during a cooling failure are being studied to reduce the heat generated by electrical equipment.

Life Systems

The centrifuge test program was approved by NASA and final test plans are scheduled for completion in August. S&ID expects to deliver the centrifuge test fixture for the DY-2 test to the Johnsville, Pa., centrifuge facility the latter part of September.

A centrifuge DY-2 test coordination meeting held at S&ID during the report period was attended by representatives from NASA-MSC, the Naval Air Development Center, and the Aviation Medical Acceleration Laboratory (AMAL). Interface problems between S&ID instrumentation requirements and AMAL capabilities were resolved and design changes were generated that modified instrumentation, programming, stressing, and training. The Naval Air Development Center furnished new information regarding the structural requirements of the centrifuge fixture that indicates structural integrity will be required in all axes to a minimum of 18 g's. A positive

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safety factor of 4 or 5 g's in addition to the 18-g minimum is desirable. The S&ID redesign, including the safety factor, will be for 27 g's as compared with the previous design for 15 g's and the minimum desired 22 g's.

Simulation and Trainers

A common digital computer is to be used in both the Apollo mission simulator and the part-task trainer.

The Apollo simulation program plan is scheduled for completion in late August. The plan as presently contemplated will be divided into two parts: a summary of the over-all simulation program plan, and detailed requirements and objectives of the program.

Evaluator 1 became operational during the reporting period, with an entry study being the first programmed effort. Production runs have been obtained to date. Modifications to the mechanization were introduced to update it and to provide easier simulated malfunction insertions. Several astronauts and members of NASA-MSC used the evaluator to perform entry simulations. Operational time of this initial entry study may be extended two additional weeks to provide astronaut familiarization training in preparation for the centrifuge tests to be conducted at AMAL during October 1963.

Structural Dynamics

A digital computer program was completed for analysis of the command module response to various sea-state conditions. The program simulates different conditions by varying the mean wave period, the peak height, and the distribution of waves of various heights. Preliminary results show that the command module can shift from one stable flotation attitude to another when exposed to sea-state IV conditions (rough sea, with waves 5 to 8 feet high).

Initial test results were obtained with the new 1/10 scale, variable-flooding command module model. For a full-scale center of gravity at $X = 39$ inches and $Z = 7.4$ inches, simulated in the 1/10 scale model, the existence of two stable flotation attitudes was confirmed for both flooded and sealed conditions. The second stable position exhibited heel angles of 147 to 131 degrees as the space between the inner and outer hulls progressively filled with water. The full-scale vehicle is expected to heel about 134 to 137 degrees for this center-of-gravity position. In the flooded condition, under the action of simulated 6-foot waves, the model tended to roll or yaw and some water could have entered the side hatch. Crew survival problems imposed by these conditions are now under study.

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Computer studies were completed, including studies of lateral bending modes for the Saturn I and IB with Apollo boilerplate and prototype spacecraft payloads. The first mode at the "start burn" conditions was 1.45 cycles per second for the boilerplate vehicle and 1.38 cycles per second for the spacecraft payload. Other calculations to be used in dynamic load studies include free-free (unrestrained) and cantilever lateral bending modes for the Saturn V with an Apollo payload.

Fabrication of the 180-degree service module structural section for the structural segment test was rescheduled for completion during the next report period. Acoustic testing will follow when instrumentation is installed and the section mounted in the acoustic chamber.

Shock, vibration, and acoustic design and test criteria were reviewed and revised to conform to the latest experimental and analytical results. Some vibration test levels were reduced, and the requirement for a simultaneous random and sinusoidal vibration test was deleted. As a result, procurement specifications are being revised that will lessen the design and test problems of some components. Pratt & Whitney Aircraft has initiated a study to determine whether the fuel cell vibration isolators can be eliminated due to the revised vibration criteria.

Checkout of the MSFC-furnished amplifiers for use in wind tunnel tests was begun. This equipment is part of the fluctuating pressure measurement device to be installed in the PSTL-2 model for the October tests at Ames Laboratories.

Two strain gauges were added to the service module of boilerplates 13 and 15 because vibration patterns may occur that could cause failure in flight. Modification to the wiring in the adapter will be required. The two strain gauges and amplifiers will be NASA-furnished.

SPACECRAFT AND TEST VEHICLES

Structures

Stability of the command module will be achieved by the use of aerodynamic flaps mounted in the launch escape tower structure instead of the side strakes, which have been deleted. Design of a dual-drogue parachute and mortar subsystem is proceeding and will provide the necessary redundancy. The forward compartment heat shield separation subsystem is being reviewed. These design changes, when completed, will be incorporated in the earliest possible boilerplate.

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Results of high-energy proton bombardment tests conducted at the Harvard University Synchrocyclotron indicate that the present three-pane Apollo window concept is satisfactory. The outer amorphous fused-silical pane was itself unaffected by proton radiation and protected the two inner aluminosilicate panes from proton-induced discoloration.

Extendible probe design studies for lunar excursion module docking—incorporating an inflatable probe, a stem-type, a stem and cable, and a tunnel concept—are in progress. (See Figure 1.) A description of these four concepts follows.

Concept I employs a soft probe extended from the command module by a vari-speed reel. Orientation with the lunar excursion module is achieved by use of the service module RCS motors without intermodule compression.

In Concept II, a ball-ended stem is manually extended by a vari-speed reel, again without intermodule compression.

Concept III makes use of a stem and cable docking mechanism in which the stem and a latch are extended by a fixed-speed reel. The stem is retracted after the latching operation, leaving a cable tie having a vari-speed reel. No intermodule compression is involved.

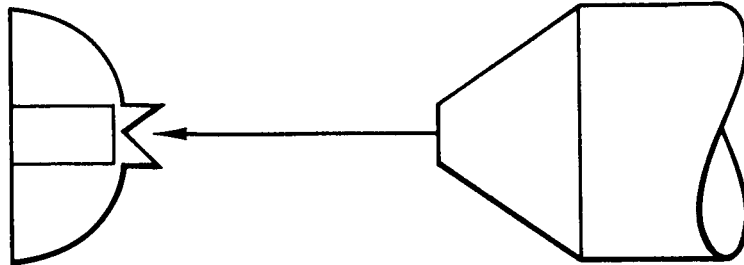
Concept IV employs an extendible, flexible tunnel for crew transfer to the other vehicle, eliminating crew exposure to the space environment except in the case of a fourth order malfunction. Orientation is accomplished by use of the service module RCS engines. Intermodule compression provides intervehicle constraints, and an air lock is established between the command module and the lunar excursion module.

Land drop tests 48 and 49 were performed on boilerplate 1. Horizontal and vertical velocity were both 27.8 feet per second with a 30-degree pitch, 0-degree roll, and 5-degree ground up-slope. Human tolerance levels were exceeded in each drop, and extensive damage was incurred by the crew couch attenuation struts. Crushable structures of different compressive values were used in the aft compartment area for these two drop tests in an effort to achieve a satisfactory kinematic design for earth landing. The honeycomb sections that were used prevented adequate structural deformation of the command module and loaded the crew couch strut system beyond the available stroking distance. The crushable honeycomb structures and the end fittings of the crew couch struts are being modified further to solve this problem.

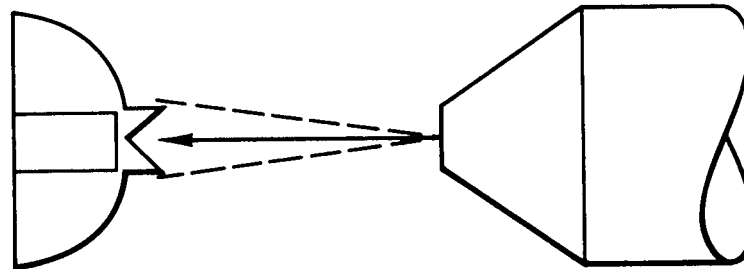
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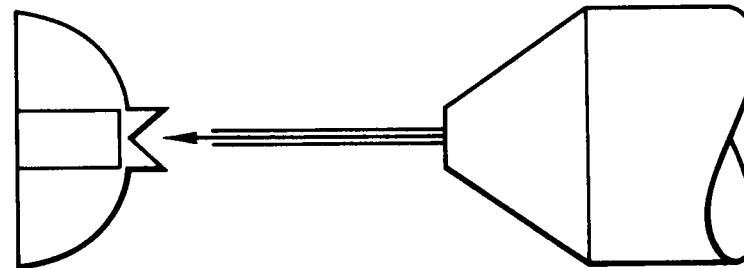
I INFLATABLE PROBE



II STEM



III STEM AND CABLE



IV EXTENDIBLE TUNNEL

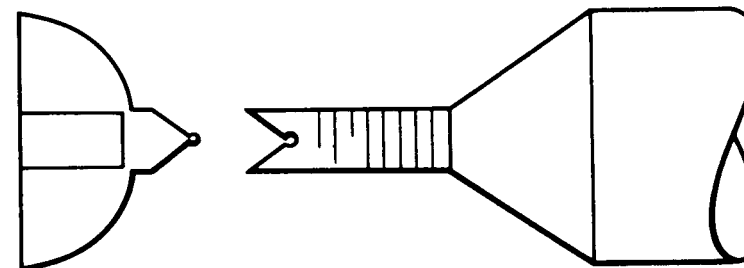


Figure 1. Docking Concepts

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An Apollo guidance and navigation (G&N) errors source book will be published in September containing the following information:

1. A description, with diagrams, of the various coordinate systems used in the Apollo mission.
2. A description, with diagrams, of the sextant-scanning telescope equipment (SXT-SCT) identifying instrument and operational errors, including numerical error breakdown.
3. A description of SXT-SCT simulation environment.
4. A description of inertial measurement unit errors.
5. A step-by-step analysis of mission errors, beginning with pad alignment and ending with reentry and touchdown, for a lunar landing mission.

The G&N subsystem coldplate design was modified and the configuration of the power and servo assembly package was redesigned to achieve greater thermal efficiency.

Centrifuge tests are scheduled to start in October at Johnsville, Pa., to evaluate reach, vision, and manipulation of G&N components on the main display panel at various g levels.

The number of G&N in-flight test subsystem (IFTS) points was reduced from 38 to 8 by MIT. The remaining points are now covered as access points on the front of the power and servo assemblies with the IFTS meter.

A digital computer program was prepared to investigate stability and performance characteristics of open loop pseudo-rate pulsing of the RCS motors. The stabilization control subsystem (SCS) flight control equations were completed and an SCS mechanization review was made.

A revised simulation program plan was written for simulator 1 G&N and SCS, including controls and displays. The simulation program includes design verification testing, failure simulation, special tests, flight verification, and a post-flight verification.

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Telecommunications

The minimum telemetry data storage recording rate for pulse coded modulation (PCM) was reviewed and a decision was made to maintain the present 1600 bits per second rate rather than increase it to the proposed rate of 2048 bits per second. The higher rate would have added excessive complexity to the data storage equipment and the prelaunch automatic check-out equipment (PACE) interleaver.

The minimum data rate reduces telemetry power requirements during the long time periods when spacecraft activity is low and a relatively small number of measurements are required. During lunar orbit, this low-rate data can be recorded by the data storage equipment while the spacecraft is behind the moon and played back at high speed for transmission to GOSS while the spacecraft is on the earth side of the moon.

As a result of the elimination of the command module strakes in which the scimitar antennas were to be located, an investigation was made of alternate designs. The substitute design selected consists of a combined VHF/2 kmc antenna that will survive entry located on the -Z axis, and a similar antenna that will not survive entry located on the +Z axis. (See Figure 2.) The location of the surviving antenna was selected to provide the

+Z (2 DEGREES OFF +Z TOWARD +Y)
 $X_C \approx 31$ TO 43
DOES NOT SURVIVE ENTRY

-Z (17 DEGREES OFF -Z TOWARD -Y)
 $X_C \approx 29$ TO 41
SURVIVES ENTRY

Figure 2. VHF/2 kmc Omni Antenna Installation

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most nearly all-directional coverage with the single antenna. The location of the non-surviving antenna was selected to provide the maximum fill-in of the -3 decibel and greater holes in the other antenna pattern. The functions of the VHF and 2 kmc antennas have been combined; the VHF antenna is the scimitar type as before, and the 2 kmc antenna consists of a separately fed notch in the edge of the VHF scimitar.

Instrumentation

S&ID is supporting the boilerplate 6 instrumentation calibration and checkout at WSMR. Flight instrumentation breadboard tests of boilerplates 12 and 13 are complete and the equipment is ready for installation upon receipt of the remaining NASA-furnished items.

Tests of the pressure and temperature sensors for test fixture 2 revealed that the sensor electronics were themselves heat sensitive. Newly developed non-heat sensitive electronics, capable of performing accurately under anticipated environmental conditions, are being installed in these sensors. Drawings and specifications are being up-dated to incorporate these changes for the sensors of spacecraft 001.

Environmental Control Subsystem (ECS)

The cooling equipment for boilerplates 13, 15, and 18 was redesigned to accommodate a change made in the GSE servicing unit. Delivery problems required procurement of a GSE service unit supplying water-glycol at 20 F instead of -35 F. This change required that the coolant tank capacity be increased from 75 to 250 pounds to operate the heat sink at 20 F instead of -35 F. Redesign of the coolant tank from a square to a cylindrical shape was necessary to withstand the higher pressures produced by the redesigned GSE servicing unit. The original servicing unit was an open-loop system that permitted air to enter the coolant tank. This condition was eliminated by redesigning for a closed-loop servicing unit that resulted in an operating pressure of 50 pounds per square inch gauge (psig) to the coolant tank instead of 4.5 psig as produced by the open-loop unit.

The ECS regenerative heat exchanger that regulated suit inlet air temperature from 50 F to 80 F was eliminated. Studies showed that the normal body heat of the astronaut will raise the constant 50 F inlet suit air temperature to comfortable levels, making the regenerative heat exchanger unnecessary.

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Electrical Power Subsystem (EPS)

Tests on the breadboard inverter resulted in undamped oscillations with half-wave loads greater than 0.5 amperes. This condition was corrected by modification of the octadic transformer and the addition of a power transistor turn-off circuit and filter choke damper winding.

Functional tests of the launch escape subsystem (LES) breadboard harness and sequencer for boilerplate 6 were completed during this report period. Preliminary data obtained indicated that all specification requirements had been met.

Electrical power for the guidance and navigation subsystem map and data viewer motor was changed from 28 volts dc to 400 cycles, 115 volts ac. A transformer will be supplied as part of the map and data viewer to step down the 115 volt power to 6 volts for use in the viewer internal illumination circuits. This change to 115 volts ac will eliminate the need for the inverter proposed by MIT, as part of the map and data viewer, to convert the previously supplied dc power to ac.

The required additional area for the EPS radiator will be accomplished by the addition of two new radiator panels. This increase from two to four EPS panels will require no panel manufacturing design changes. The new design provides modulation controls that permit the selection and use of five different panel combinations. This control plan optimizes radiator heat rejection capabilities and provides for subsystem growth.

During the report period, Pratt & Whitney continued to experience fuel cell test failures that resulted in the production of water contaminated with the potassium hydroxide electrolyte. The majority of these failures occurred either on start-up or were caused by external factors such as valve manipulations to remove entrapped water.

Abort initiation circuitry changes in boilerplate 12 provide a sequencer abort mode that is compatible with the Little Joe II thrust termination system. The change provides a hot wire or loss of power initiating devices to ensure successful mission abort by the addition of wiring and relays to start the coded timer. The GSE equipment models affected are the test conductor group, the electrical junction box, and the launch equipment sequencer bench maintenance equipment.

Radio command abort effective on boilerplate 22 and spacecraft 002 requires redesign of the LES sequencer to remove the timers used to initiate abort, add redundant circuitry to the vehicle to accommodate redundant command signals from Little Joe II, and modify GSE to delete the timer monitor and add the radio command monitor.

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Electronic Interfaces

The design of the command module display and controls main console was frozen. Procurement and manufacturing of the panels are proceeding.

A study was made of GSE access point space allocation problems for the command module data distribution panel. Adequate space for the GSE access points will be made available by mounting some distribution (but not access) points on a side panel behind the main data distribution panel. The GSE test points will be made accessible during ground tests by removing the data storage unit from its normal flight mounting position.

Service Propulsion Subsystem (SPS)

Sixty-nine firings were made in the injector development program during the report period. A doublet injector pattern that demonstrated both stable operation and ablative chamber compatibility was selected as the prototype design. Table 2 lists all test firings made during the report period.

The second simulated altitude firing of a full-scale SPS engine was conducted at AEDC. High-frequency combustion instability occurred on start-up and resulted in minor damage to the engine that required replacement of the thrust chamber and titanium nozzle extension.

Recent test cell changes failed to produce the desired results. The test cell configuration will be returned to that used during the initial firing conducted in June.

Test fixture F-1 was completed, and test fixture F-2 is scheduled to be completed in August. Delivery of test fixture F-2 will be made as soon as instrumentation is received. Test fixture F-3 is being reworked to the latest spacecraft engine installation configuration and should also be completed during the next report period.

The capillary reservoir in the SPS propellant tanks is being redesigned to improve propellant feed-out under zero-g starting conditions. This redesign will include a reservoir capacity at the tank outlet sufficient for five seconds of engine firing under all mission modes. The RCS ullage maneuver prior to firing of the SPS engine is now expected to position the propellant at the tank outlet in the reservoir with less total RCS burning time required than would be necessary for settling the fluid in the entire downstream tank. Capillary screens will be placed in the reservoir to act as gas separators to dampen wave motion and retain propellant at the tank outlet during low-g periods.

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Table 2. Injector Development Test Program
Apollo Service Propulsion Engine

Serial Number	Pattern Type	Type of Evaluation	Number of Firings	Number of Unstable Firings	Total Firing Time (Sec)	Remarks
AF-29	Doublet	C*	6	0	34.0	C* = 5468 to 5545
		Injector/ chamber compatibility	10	0	1,956.0	Compatibility demonstrated
AF-19	Doublet	Stability	4	3	362.0	
		C*	9	1	49.0	
AF-20	Doublet	C*	6	0	31.0	
AF-1	Long Im- pingement, Triplet	Stability	3	3	6.5	N ₂ injection investigated
AFF-1	Doublet	C*	1	1	4.0	Ruptured all pie segments
AFF-2	Doublet	C*	1	1	3.0	Oxidizer pie segment separated
AFF-3	Quadlet	C*	10	0	62.0	
		Injector/ chamber compatibility	2	0	104.0	Incompatible
AFF-4	Quadlet	C*	5	0	26.5	
		Injector/ chamber compatibility	2	0	210.0	Slight streaking
AFF-6	Quadlet	C*	5	3	15.0	
BF-19	Doublet	Stability	1	0	200.0	Slight erosion on baffle
		Injector/ chamber compatibility	2	0	210.0	Severe erosion
C* = Characteristic exhaust velocity						

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Reaction Control Subsystems (RCS)

Most of the fabrication problems on the RCS positive expulsion tank shell were resolved. A definitive contract for Bell Aerosystems is being prepared.

Test 7 of the service module RCS breadboard, Phase I, to simulate regulator failure is in progress. Simulation tests of a failed-open primary stage, a failed-open secondary stage, and a failed-closed primary stage were completed for one bank of regulators. Data are being reduced. Observations of low response instrumentation revealed no apparent subsystem discrepancies. Detail design work for the Phase II breadboards of both the service and command module RCS was begun.

The command module RCS propellant dump unit was reviewed by NASA during a propulsion subsystems panel meeting at MSC, at which time S&ID recommended the use of subsystem interconnects to accomplish more reliable expulsion of propellants. Release was completed of all command module RCS propellant dump unit drawings, including the system interconnects.

Command module RCS Phase I engines 28, 29, and 35 were tested during this report period. Unit 28, having macerated ablative material with a Gemini experimental throat, completed the mission duty cycle. Moderate glassing (fusing) and severe erosion occurred in the combustion chamber. The ablative material had a 360 degree circumferential fracture immediately behind the throat. Unit 29 failed after 35 seconds of acceptance testing; unit 35 failed after 55 seconds of acceptance testing.

Eight command module RCS tests were performed on Phase I injector 5 to determine injector performance with enlarged propellant orifices. This injector was then used in the assembly of engine 30, on which six ambient and four altitude tests were performed. Engine failure due to chamber pressure decay was observed during the last altitude test. The cause of the failure is being investigated.

The engine prototype test program for the service module RCS was initiated. Preliminary data on the first test firing show a specific impulse slightly less than 300 seconds. The drift of Marquardt's test cell 6 thrust measurement unit is no longer a problem.

Launch Escape Subsystems (LES)

Ten pyrogen tests using hotwire igniter cartridges have been conducted—six employed dual igniter cartridges fired at 150 F, and the

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remaining four were fired at 10 F using only a single hotwire igniter cartridge. The ignition delay of the dual cartridge firings was well within that experienced with exploding bridge wire. The ignition delay, however, of the single initiator firings was considerably longer than expected (up to 200 milliseconds). All future testing will employ only igniter cartridges.

The retrofit of the two tower jettison motors with modified interstages was completed at WSMR. After being reworked, a leak check on the motors indicated that the re-assembly of the motors was satisfactory.

Three tower jettison motors were fired during the report period. Motor AD-7 was fired at 20 F using hotwire igniter cartridges. This motor had experienced vibration tests, drop tests, and temperature cycling. Motor AD-24 was fired for ballistic verification at 70 F. Motor AD-18 was fired at 70 F after the completion of vibration testing and was ignited under simulated altitude, using hotwire cartridges. All test objectives were met within specification limits.

The pitch control motor development test program was completed with the firing of four motors. PC-23 and PC-24 were fired successfully with hotwire cartridges at 140 F and 20 F, respectively, after accelerated aging for 75 days at 160 F. Motor PC-25 was fired at 20 F with simulated altitude ignition conditions, after undergoing vibration and drop testing; PC-33 was fired in a ballistic centrifuge while being subjected to a lateral acceleration of 19 ± 1 g at 140 F.

A total of five launch escape motors were found to have cracks in the propellant. The cracks were caused apparently by excessive amounts of moisture that had accumulated on the propellant surface during and between environmental treatments of the motors. Moisture is known to decrease the physical strength of the polysulfide propellant significantly. Methods of desiccating the launch escape motor for short and long term storage to prevent recurrences of moisture accumulation are being studied.

INTEGRATION

System Integration

A briefing on the range safety program was presented to NASA-MSC at Houston. The program covered WSMR, AMR, and global entry range safety. The briefing stressed program schedules, design, crew safety, and reliability. NASA will indicate range safety requirements affecting Apollo design, with S&ID providing support on a task and test article basis as required.

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The measurement requirements lists for boilerplates 14, 18, and 22 and spacecraft 008 and 011 were frozen. Measurement revisions for boilerplates 13 and 15 were released.

Ground Support Equipment (GSE)

A NASA-S&ID special test unit (STU) review meeting was held. The meeting resulted in the elimination of the STU fluid servicing control unit and the substitution of several small models that provide for local manual control. The module concept of STU design cannot be used for the new models, which must operate under exposed environmental conditions. The design control specifications for all STU models were completed, and detail design is proceeding on schedule.

A complete review of the requirements for GSE substitute units to ensure that all operating conditions of the STU and PACE units are satisfied should be completed in August.

A meeting was held at AMR on 1 August, at which NASA and General Electric presented the PACE-spacecraft system configuration, emphasizing the control and computer room layouts. Incompatibility was found between the sizes of the facilities planned for AMR and S&ID. NASA-MSC will define identical control room layouts, panel details, and programming requirements for both AMR and S&ID. This information is expected during the next report period.

Requirements for the external conditioner/PCM unit were established, based on the need for signal conditioning equipment in the PACE-spacecraft. These conditioners handle measurements that must be monitored by PACE-spacecraft during tests, such as combined system tests for which additional signal conditioning is required or for which the PACE-spacecraft carry-on equipment is not available. This equipment will accept analog data from the spacecraft and properly condition it for insertion into the PACE-spacecraft data format.

A summary has been completed for PACE-spacecraft and STU use of the analog stimuli and discrete commands necessary to check out the SCS. Both ac and dc stimuli will be generated and adjusted within the SCS checkout STU. A remote box containing control relays will be located near the SCS to apply and remove the stimuli, thus eliminating the need for long electrical leads from the SCS stimuli points.

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Analyses are being made concerning the replacement of explosive bridge wire circuitry with hot bridge wire circuitry in the test conductor/assistant test conductor console and the launch escape sequence unit bench maintenance equipment.

All GSE equipment schematics and design drawings for boilerplate 12 were completed, including those for the test conductor/assistant test conductor console and the C-band beacon antenna coupler. The inter-connect diagrams for these two units were also completed.

The current GSE model summary is shown in Table 3, which gives the status of the different GSE models and classifies them by auxiliary, checkout, handling, and servicing types.

Table 3. Current GSE Model Summary

Model	Auxiliary	Checkout	Handling	Service	Totals
	Status				
Active models and configurations	85	131	133	56	405
NASA approved	63	87	96	43	289
Shop released	71	94	110	46	321
Fabrication complete	16	13	55	1	85

Technical Operations

The present status of the interface control documentation is shown in Table 4. A total of 538 interface control documents (ICD) were identified as of 15 August. Of this total, 13 were approved by NASA; 41 were approved by S&ID; and 19 out of 137 applicable ICD's were approved by associate contractors. Of the 51 ICD's affecting MIT, 13 received all necessary signature approvals, and 6 additional ICD's were approved by S&ID only. Of the 7 ICD's affecting Convair, 6 were signed by S&ID and Convair. S&ID approved 15 of the 156 NASA Inter-Center ICD's.

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Table 4. Interface Control Documentation Status Report
Through 15 August 1963

Associate Contractor	Total Known ICD List	Approved by S&ID	Approved by S&ID	Approved by Associate Contractors
NASA Inter-Center	156	0	15	--
NASA (MSC) Electrical Systems Division	39	0	0	--
NASA (MSC) Crew System Division	0	0	0	--
NASA (MSC) Preflight Operations Division	206	0	0	--
MIT	51	13	20	13
General Dynamics - Convair	7	0	6	6
Hamilton Standard	33	0	0	0
Grumman	46	0	0	0
General Electric	0	0	0	0
Totals	538	13	41	19

Reliability

Test results for all pyrotechnic devices through 6 August, are summarized in Table 5.

Test status reports will be updated weekly and expanded to include other types of flight hardware. Subsequent test status reports will include the qualification requirements defined for each hardware item to be used on each flight vehicle.

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Table 5. Weekly Test Status of Pyrotechnic Devices

Component	Supplier	Total Number of Tests	Failures	Usage	Reference Note No.
EBW initiator (predisconnect)	Aerojet	406	8	BP-6 only	1
Standard hotwire initiator	SOS	430	42	All BP and SC	2
Pressure cartridge, type I	SOS	0	0	All BP and SC	3
Pressure cartridge, type II	SOS	0	0	All BP and SC	3
Pressure cartridge, type III	SOS	28	0	All BP and SC	
Detonator	SOS	110	4	All BP and SC	4
Igniter cartridge	SOS	0	0	BP 12 and subsequent BP's	
Explosive bolt, single	SOS	55	0	BP 6 only	
Explosive bolt, dual mode	Not selected	0	0	BP 12 and subsequent BP's	
				BP and SC	
S01-314 hotwire initiator	SOS	76	0	BP 6 only	
Drogue chute disconnect	S&ID	13	1	BP 6 only	5
Main chute disconnect	N-V	4	2	BP 6 and subsequent BP's	6
Drogue chute mortar	N-V	1	1	All BP and SC	7
Pilot chute mortar	N-V	0	0	All BP and SC	
Forward heat shield separation unit	S&ID	8	0	BP 6 only	
Tower separation unit	S&ID	7	0	BP 6 only	
Command to service module separation unit	S&ID	0	0	BP 12 and subsequent SC	
Adapter separation unit	S&ID	0	0	BP 18 and subsequent SC	
Umbilical disconnect	S&ID	0	0	SC 9 and subsequent SC	
Circuit interrupter	Not selected	0	0	SC 9 and subsequent SC	
Launch escape motor ignition	Lockheed	11	1	BP 6 only	
Pitch control motor ignition	Lockheed	20	1	BP 6 only	
Tower jettison motor ignition	Thiokol	17	0	BP 6 only	

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Table 5. Weekly Test Status of Pyrotechnic Devices (Cont)

Component	Supplier	Total Number of Tests	Failures	Usage	Reference Note No.
Tower separation unit	S&ID	0	0	BP 12 and subsequent BP and SC	
Launch escape motor ignition	Lockheed	0	0	BP 12 and subsequent BP and SC	
Pitch control motor ignition	Lockheed	4	0	BP 12 and subsequent BP and SC	8
Tower jettison motor ignition	Thiokol	5	0	BP 12 and subsequent BP and SC	8
Forward heat shield separation unit	S&ID	0	0	BP 12 and subsequent BP and SC	
<p>BP = boilerplate SC = spacecraft</p> <p>SOS = Space Ordnance Systems N-V = Northrop-Ventura</p> <ol style="list-style-type: none"> 1. The most recent failure occurred during checkout of the electrical harness at S&ID on 21 July. The previous seven failures were caused by insufficient power applied to the exploding bridge wire firing unit or by use of leakers that had become desensitized due to absorption of cleaning solvent. 2. Thirty-nine failures were inadvertent firings in static sensitivity tests during the development program. 3. Pressure cartridges, types I and II, are being reworked by the supplier because the original lots had double charges. 4. During recent tests of the main chute disconnect at Northrop-Ventura, one detonator fired prematurely at low temperature; two detonators failed to fire the linear-shaped charge; one detonator fractured. 5. The listed failure was an incomplete severance of the tension plate with zero-tension load. The plate would probably have separated if the design load had been applied during the test. 6. Because of the failures indicated in note 4, the cause of the main chute disconnect failure for boilerplate 6 is not yet determined. 7. The single test firing failed because one cartridge split as a result of being loaded with a double charge (see note 3). 8. Test firings were conducted with prototype igniter cartridges; however, Space Ordnance Systems igniter cartridges will be used as soon as they are available. 					

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Identification and traceability briefings were presented separately to Rocketdyne and Marquardt to introduce the subcontractor/supplier requirements as delineated in MA0201-0209 (released 24 July). Revision A to this specification should be released in August to clarify questions concerning the NASA-MSFC code and to relieve the requirement for NAA approval of all supplier exemptions prior to initiation of supplier manufacturing and procurement processes. The Government Inspection Agency (GIA) representatives were also briefed, at the request of NASA RASPO, on the S&ID Apollo identification and traceability system.

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OPERATIONS

DOWNEY

Approximately twenty-four major engineering orders for the rework of the boilerplate 6 workstand have been fulfilled. The stand has been submitted for S&ID and NASA inspection, disassembled, painted, and reassembled. The stand will be shipped to WSMR immediately upon acceptance by inspection.

The boilerplate 12 manufacturing buildup is continuing; the wiring harnesses have been installed; buildup of the launch escape subsystem (LES) has been initiated; and Manufacturing has finished power-on tests, using SMD (systems measuring devices) equipment. NASA-supplied instrumentation components, not including the TMS 090 Microdot temperature system, are available for installation.

Manufacturing buildup of the boilerplate 13 command module and GSE is continuing. Some items of GSE remain as "pacing" items. The design of the carry-on cable for use with the boilerplate 13 Chrysler console has been completed. Modifications to the console for the vibration-transducer test are continuing. The requirements for the special adapter devices to be used with the SMD for boilerplate 13 checkout have been reviewed.

The boilerplate 15 instrumentation breadboard has been received for test preparation. Approximately one-half of the flight hardware has been received.

Breadboard testing of boilerplate 16 flight hardware has been started.

The boilerplate 23 instrumentation breadboard testing is in progress. Approximately one-half of the continuity tests have been completed.

Detailed test runs for spacecraft 008 in the environmental chamber at MSC are being studied. The test runs are being delayed, however, by the lack of firm stimuli requirements.

Installation, checkout, and acceptance testing of the digital system of the interim data station has been completed, with all specifications satisfied.

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A computer program to compute angular acceleration, linear acceleration, elevation angle, and azimuth angle with respect to the center of gravity of the command module for the Apollo land and water impact program is in final checkout.

Test fixture F-2 was moved to the NAA-Los Angeles Division clean tent for assembly of the propellant system. After repairs to some low-pressure leaks, the fixture completed the NASA manufacturing-completion inspection and was delivered to the NAA-Los Angeles Division engineering laboratory for checkout.

WHITE SANDS MISSILE RANGE

The boilerplate 6 receiving inspection, buildup of the command module, and horizontal weighing and balancing were completed, except for the main parachutes and pyrotechnics. The buildup, weighing and balancing, and painting of the LES were accomplished. The launch pad adapter was installed and alignment verification completed. The command module, LES, and associated GSE were then moved to the mission abort launch pad where the command module was placed on the adapter and the alignment reverified. The boilerplate and the LES were mated for operational test procedure (OTP) verification. Upon completion of the preliminary OTP checkout, the boilerplate command module, LES, and associated GSE were demated, moved to the new WSMR vertical assembly building, and reassembled. The boilerplate will undergo verification and installation of qualified main parachutes and pyrotechnics. After the qualification shot of the Little Joe II, it will be moved back to the launch pad.

The telemetry trailer buildup, preliminary checkout, and OTP verification have been completed. Work-off of "squawks," repairs, and installation of the three transformers for protection against WSMR power supply fluctuations have been completed. The functional OTP verification was completed, and the trailer is now operational.

Buildup, checkout, and final OTP verification have been completed, and the checkout trailer is now operational.

The construction of the propulsion system development facility (PSDF) access road and the water-well access road is continuing. The concrete for the above-grade wall at the PSDF test area control center has been poured. Final grading and reinforcing is being prepared for the ground floor slab. Underground transite electric and instrumentation conduits have been installed and concrete-encased. Most of the tunnel has been completely poured and waterproofed. The concrete for the outside walls of the test

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stand has been poured. The concrete has also been poured for the cooling water tank wall, and work is in progress on the tank bottom and the foundations for the fuel and oxidizer dump tanks.

ATLANTIC MISSILE RANGE

At a joint meeting between S&ID and NASA to establish the configuration and operational requirements of each item of the systems test units (STU), NASA imposed the following ground rules on the STU:

STU will not remotely control servicing equipment.

One STU will not control another STU.

Several meetings were held with NASA-POD to discuss the control room layout of the AMR operations and controls (O&C) building and the individual system consoles to be housed within the control room. An agreement was made to update the PACE control room document. It would include PACE O&C control room layout, individual system console layouts, test conductor console layout (and parameters to be monitored), a revised list indicating the types of parameter monitoring required together with recording requirements, and a listing of the various types of monitoring modules required per system.

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DOWNEY FACILITIES

SYSTEMS INTEGRATION AND CHECKOUT FACILITY (BUILDING 290)

The pouring of concrete slabs is on schedule; it is approximately 90 percent complete. The fire protection system is 75 percent complete, and overhead mechanical and electrical work is on schedule.

BUILDING 6 MODIFICATION AND DATA GROUND STATION

Phase 1 of the building 6 modification was completed 9 August. Approximately 1,000 people were moved into the first floor of building 6 during the weekend of 9 August, part of the relocation of approximately 5500 people planned for the next sixty days.

A representative from Apollo facilities visited the General Electric Light Military Plant in Utica, New York, to review Sky Bolt test equipment in termination status for transfer to S&ID. Requests were submitted against Air Force Contract 9546 for equipment.

APPENDIX

S&ID SCHEDULE OF APOLLO MEETING AND TRIPS



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S&ID Schedule of Apollo Meetings and Trips 16 July to 15 August 1963

Subject	Location	Date	S&ID Representatives	Organization
Reliability review	Sacramento, California	16 July	Wolcott	S&ID, Aerojet-General
MSC briefings	Houston, Texas	16 July	Brady, Grover	S&ID, NASA
Propulsion meeting	Houston, Texas	16 July	Svenson	S&ID, NASA
Monthly progress meeting	Indianapolis, Indiana	16 July	Arnold, Furman, Brehaut, Milberger, Westfall	S&ID, GM-Allison Division
Radioisotopes discussion	Houston, Texas	16-17 July	Svenson	S&ID, NASA
Propulsion systems meeting	Bethpage, Long Island, New York	16-17 July	Hines, Wolfelt	S&ID, Grumman
Facility survey	Minneapolis, Minnesota	16-18 July	Dieterle	S&ID, Minneapolis-Honeywell
Logistics presentation	Houston, Texas	16-18 July	Bankson	S&ID, NASA
Abort coordination	Minneapolis, Minnesota	16-18 July	Tutt, Kishi	S&ID, Minneapolis-Honeywell
Code procurement	Marietta, Georgia	16-18 July	Liley	S&ID, Lockheed
Crew systems meeting	Houston, Texas	16-18 July	Brewer, Dziedziula, Hornick, Cureton	S&ID, NASA
Fuel cell coordination	Downey, California	16-19 July	Anderson	S&ID, NASA
Contractor conference	Huntsville, Alabama	16-19 July	Cooper	S&ID, NASA
Recovery antenna meeting	Melville, Long Island, New York	16-20 July	Shaw	S&ID, Airborne Instrument Laboratory
Wing tunnel tests	Mountain View, California	16-22 July	Allen, Pryor, Takvorian, Vardoulis, Canetti, McNary, Kobota	S&ID, Ames
Interface, IDWA, and crew provision meeting	Bethpage, Long Island, New York; Columbus, Ohio; St. Louis Missouri	16-24 July	Brockman, Tarr, Hair	S&ID, Grumman S&ID, NAA-Columbus S&ID, McDonnell
Contract negotiations	Buffalo, New York	16 July 4 August	Myers, Hobsin, White, Bevington, Burge	S&ID, Bell Aeosystems
SCS BME review	Downey, California	16 July	Svegel	S&ID, NASA



S&ID Schedule of Apollo Meetings and Trips (Cont)
16 July to 15 August 1963

Subject	Location	Date	S&ID Representatives	Organization
Equipment implementation	Houston, Texas	17 July	McMullin, Siwolop, Shelley, Gebhart, Monford, Guimont	S&ID, NASA
Thermal interface meeting	Downey, California	17 July	Lane, Percy	S&ID, NASA, MIT
Interface meeting	Houston, Texas	17-18 July	Pratt	S&ID, NASA, Hamilton Standard, Grumman
Injector test evaluation	Sacramento, California	17-18 July	Mower	S&ID, Aerojet-General
Low frequency presentation	Sacramento, California	17-18 July	Chen, Szalwinski	S&ID, Aerojet-General
Space suits and environmental meeting	San Diego, California	17-18 July	Waters	S&ID, Naval Air Station
Structural details resolution	Houston, Texas	17-19 July	Jobson, Brundin, Waterbury, Bratt	S&ID, NASA
GSE producibility problems	Tulsa, Oklahoma	17-19 July	Collipriest	S&ID, NAA-Tulsa
Measurement review	Houston, Texas	17-19 July	Eckmeier, Schmitz, Jarvis, Gershun	S&ID, NASA
Guidance and navigation systems meeting	Houston, Texas	17-19 July	Johnson, Timothy, Yumiba	S&ID, NASA
Field analysis meeting	Lowell, Massachusetts	17-21 July	Lowery, Morant, Harris, Peterson, Greagan	S&ID, Avco
Operational test procedure coordination	WSMR	17-24 July	McFarland	S&ID, NASA
HA-1 briefing	Houston, Texas	17-24 July	Green, Hair	S&ID, NASA
Engineering changes preparation	WSMR	17-26 July	Harris	S&ID, NASA
Engineering evaluation	Berkeley, California	18 July	Gordon	S&ID; Hexcel Products, Inc.
Coordination meeting	Downey, California	18-19 July	Lane, Levine	S&ID, NASA, MIT
Forging inspection	Cudahy, Wisconsin	18-19 July	Krainess	S&ID, Ladish
Electronic systems discussion	Houston, Texas	18-19 July	Miller, Lu	S&ID, NASA
Guidance and control simulation	Cambridge, Massachusetts	18-19 July	Martin, Siev	S&ID, MIT

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 July to 15 August 1963

Subject	Location	Date	S&ID Representatives	Organization
Stock inventory meeting	WSMR	18 July 9 August	Brewington	S&ID, NASA
Parachute drop tests	El Centro, California	18 July 16 August	Young, Duffy, Trebes	S&ID, Naval Air Station
Boilerplate coordination	WSMR	19-21 July	Barr	S&ID, NASA
Wind tunnel tests	Hampton, Virginia	21 July	Lundy, Cummings, Esparza, Lundy, Gillies	S&ID, Langley Research Center
Pyrotechnic panel meeting	Houston, Texas	21-22 July	Champaign, Hitchens, Holloway, Frazer	S&ID, NASA
Spares requirement coordination	Columbus, Ohio	21-22 July	Berry, Calvert	S&ID, NAA-Columbus
Pretest conference	Tullahoma, Tennessee	21-23 July	McNary	S&ID, AEDC
Integrated mission control center (IMCC) and simulation and checkout training system (SCTS) information	Houston, Texas	21-24 July	Rogers, Day, Bowers, Matisoff	S&ID, NASA
GSE requirements location	Cocoa Beach, Florida	21-24 July	Wright, Dorian, Barajas, Sweeney	S&ID, NASA
Boilerplate coordination	WSMR	21 July 10 August	Pearce	S&ID, WSMR
Launch preparations	Houston, Texas	22 July	Perry	S&ID, NASA
Wind tunnel tests	Tullahoma, Tennessee	22 July	Moote	S&ID, AEDC
Technical coordination	Sacramento, California	22 July	Borde	S&ID, Aerojet-General
Test site center meeting	WSMR	22-23 July	Moddrell	S&ID, NASA
Mission trajectory meeting	Houston, Texas	22-23 July	Rider, Kakuske, Meston	S&ID, NASA
Structural-mechanical system meeting	Houston, Texas	22-24 July	Johnson, Nicholas, Ellis, Underwood, Krimgold	S&ID, NASA
Instrumentation sub-system	Houston, Texas	22-24 July	Page, Dorrell, Chicavacci, Bartholomew	S&ID, NASA
GSE meeting	Houston, Texas	22-25 July	Embody, Baker, Bagnall, Moore, Hisey	S&ID, NASA



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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 July to 15 August 1963

Subject	Location	Date	S&ID Representatives	Organization
Configuration control check	WSMR	22-26 July	DeVore, Maleck	S&ID, NASA
Design review meeting	Cedar Rapids, Iowa	22-28 July	Downes, Marine, Griffiths, Milham, Calvert, Cole	S&ID, Collins
Test panel meeting	Houston, Texas	23-24 July	Harvey, Stungis, Bendeas, Gore	S&ID, NASA
Flight technology meeting	Houston, Texas	23-24 July	Tutt	S&ID, NASA
Interface systems meeting	Houston, Texas	23-25 July	Richardson	S&ID, NASA, Grumman
Requirements support discussion	Houston, Texas	23-25 July	Coulson, Dyer	S&ID, EAFB
Manual support meeting	WSMR	23-26 July	Dooley, Polosky, Davis	S&ID, NASA
Reaction control system meeting	Downey, California	24-25 July	Gibb, Lane	S&ID, NASA, Grumman
Checkout work group	Cambridge, Massachusetts	24-26 July	Secrist, Day	S&ID, MIT
Test observations	Houston, Texas	25 July	Armstrong	S&ID, NASA, USAF, MIT
Design coordination	Tulsa, Oklahoma	27-31 July	Bluhm	S&ID, NAA-Tulsa
Breadboard configuration control meeting	AMR	28 July	Stott	S&ID, NASA
Data coordination	Cedar Rapids, Iowa	28-30 July	Schepak	S&ID, Collins
Supply operations orientation	WSMR	28-30 July	McDonald	S&ID, NASA
Toxicity conference	Palo Alto, California	28-31 July	Hendel, Edgerly	Symposium
Wind tunnel tests	Huntsville, Alabama	28 July 4 August	Snowden, Miller,	S&ID, AEDC
Fact-finding analysis	Princeton, New Jersey	28 July 4 August	Shear	S&ID, RCA
Impact discussion	Houston, Texas; Huntsville, Alabama	29 July	Courtis	S&ID, NASA
Field analysis	Middletown, Ohio	29 July	Peterson, Stover	S&ID, Aeronca
Technical coordination	Chicago, Illinois	29 July	Traver	S&ID, Elgin

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 July to 15 August 1963

Subject	Location	Date	S&ID Representatives	Organization
Flight technology systems meeting	Houston, Texas	29 July	Goldman	S&ID, NASA
Food subcontract coordination	Palo Alto, California	29-30 July	Osborne	S&ID, Stanford Research Institute
Design coordination	Tulsa, Oklahoma	29-31 July	Budzisz	S&ID, NAA-Tulsa
Contract negotiations	Newberry Park, California	29-31 July	Cagni	S&ID, Northrop-Ventura
Trainer systems meeting	Houston, Texas	30 July	Marshall	S&ID, NASA
Programming procedures	Houston, Texas	30 July	Dorsey	S&ID, NASA
Response system design	AMR	30 July	Manaker	S&ID, NASA
Stabilization and control system meeting	Minneapolis, Minnesota	30 July	Saterlie	S&ID, Minneapolis-Honeywell
Heat shield simulation coordination	College Park, Maryland	30 July	Bush	S&ID, Radcom
Test program establishment	Corning, Pennsylvania	30 July	Corpening	S&ID, Corning
Mission planning systems meeting	Houston, Texas	30-31 July	Miller	S&ID, NASA
GSE requirements review	Houston, Texas	30 July 2 August	Poole	S&ID, NASA, Grumman
Qualification testing	Joplin, Missouri	30 July	Otzing	S&ID, Eagle-Picher
Subcontractor review	Binghamton, New York	30 July	Banta	S&ID, GPI-Link Division
Operation test procedure review	Houston, Texas	30 July 3 August	Garcia	S&ID, NASA
Mission simulator review	Binghamton, New York	30 July	Hatchell, Kerr	S&ID, GPI-Link Division
Information procurement	Cedar Rapids, Iowa	31 July	Stanley	S&ID, Collins
Quality control review	Minneapolis, Minnesota	31 July	Wessling	S&ID, Minneapolis-Honeywell
GSE coordination	AMR	31 July	Hillberg	S&ID, NASA
Budget and rate analysis	Sacramento, California	31 July 1 August	Leffler	S&ID, Aerojet-General



S&ID Schedule of Apollo Meetings and Trips (Cont)
16 July to 15 August 1963

Subject	Location	Date	S&ID Representatives	Organization
Configuration control discussion	Tulsa, Oklahoma	31 July	DeVore	S&ID, NAA-Tulsa
Integrated test procedure	WSMR	31 July 3 August	Nobles	S&ID, NASA
Documentation deficiencies coordination	Newberry Park, California	1 August	Nichols	S&ID, Northrop-Ventura
Requests and changes review	Houston, Texas	1-2 August	Lashbrook, Brown	S&ID, NASA
Q-ball alignment meeting	Houston, Texas; AMR	1-3 August	Van Meter	S&ID, NASA
Service propulsion engine weight review	Sacramento, California	4-6 August	Colston	S&ID, Aerojet-General
Launch operations panel meeting	AMR	4-9 August	Gardners	S&ID, NASA
Maintenance capabilities investigation	AMR; St. Louis, Missouri	4-9 August	Edelstein	S&ID, NASA; S&ID, McDonnell
Gauging systems negotiations	Burlington, Vermont; Ballston, New York; Deer Park, New York	4-11 August	Gleason	S&ID, General Electric; S&ID, GE-Malta Test Facility; S&ID, Aerotest Laboratories
Manufacturing discussion and burst test	Elkton, Maryland	5-7 August	Yee	S&ID, Thiokol
In-flight maintenance	Houston, Texas	6 August	Molesko	S&ID, NASA
GSE coordination	Sacramento, California	6 August	Martinson	S&ID, Aerojet-General
Monthly design meeting	Melbourne, Florida	6 August	Britton, Stasko	S&ID; Radiation, Inc.
Lunar landing program plan	Houston, Texas	6-7 August	Robinson	S&ID, NASA
S-band coordination	Cedar Rapids, Iowa	6-8 August	Hall	S&ID, Collins
Control center procedures	WSMR	6-10 August	Henderson	S&ID, NASA
Proposal evaluation and facility survey	Natick, Massachusetts; Newark, New Jersey; Indian Head, Maryland	6-13 August	Kicinski, Moen, Brooks	S&ID, Space Sciences, Inc.; S&ID, Daystrom Weston Instruments; S&ID, Nanmac Corporation

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 July to 15 August 1963

Subject	Location	Date	S&ID Representatives	Organization
Engineering coordination	Boulder, Colorado	7 August	Haglund, Korb, Arnold	S&ID, Beech
Test planning and logic discussion	Houston, Texas	7 August	Graham	S&ID, NASA
Scheduling and hours expenditure resolution	Tulsa, Oklahoma	7-8 August	Ryan, Harris	S&ID, NAA-Tulsa
Integration discussion	Houston, Texas	7-8 August	Vucelic, Clary, Graham	S&ID, NASA
Contract change meeting	WSMR	7-9 August	Dunlop	S&ID, NASA
Technical coordination	Minneapolis, Minnesota	7-9 August	Newton, Schroeder, Levine, Kalayjian	S&ID, Minneapolis-Honeywell
Test data system review	Melbourne, Florida	7-9 August	Rutkowaski	S&ID; Radiation, Inc.
Glass window irradiation	Oak Ridge, Tennessee	7-10 August	Okumura	S&ID, Oak Ridge National Laboratory
Bench test procedures	AMR	8-9 August	Ree, Hemond, Harris, Himmelberg, Zeek, Whitehead, Jorgenson, Sturkie	S&ID, NASA
Parachute tests	Mountain View, California	8-9 August	Allen	S&ID, Ames
Wind tunnel discussion	Moffet Field, California	8-9 August	Young, Youst	S&ID, Ames
Docking design discussion	Bethpage, Long Island, New York	8-11 August	Lu, Righter	S&ID, Grumman
Heat transfer conference	Boston, Massachusetts	11-15 August	Barnett, Gershun	Symposium
Communications and instrumentation	Cedar Rapids, Iowa	11-23 August	McCredie	S&ID, Collins
Technical coordination	Sacramento, California	12 August	Ross, Borde	S&ID, Aerojet-General
Displays panel meeting	Houston, Texas	12-13 August	Hughes	S&ID, NASA
Monthly coordination	Houston, Texas	12-14 August	Nelson, Copeland, Haky, Bouman, Olsen, Thomas, Nash, Carey, Iwasaki, Reithmaier, Ostraski	S&ID, NASA
Difficulties discussion	Minneapolis, Minnesota	12-14 August	Fleck	S&ID, Minneapolis-Honey

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S&ID Schedule of Apollo Meetings and Trips (Cont)
16 July to 15 August 1963

Subject	Location	Date	S&ID Representatives	Organization
Engineering representative	WSMR	12-17 August	Fugikawa	S&ID, NASA
EMI test plan	WSMR	12-29 August	Pumphrey	S&ID, NASA
Astronaut system briefing	Houston, Texas	13-14 August	Smith	S&ID, NASA
Crew safety integration	Huntsville, Alabama	13-15 August	Vucelic, Tutt	S&ID, NASA
Mechanical integration panel meeting	Houston, Texas	13-15 August	Tooley, Johnson	S&ID, NASA
Interface discussion	Bethpage, Long Island, New York	13-15 August	Gustavson, Stacy, Richardson	S&ID, Grumman
Monthly coordination	Boulder, Colorado	13-16 August	Carter, Bouman, Williams	S&ID, Beech
Docking simulation study	Columbus, Ohio	13-18 August	Bohlen, Krimgold	S&ID, NAA-Columbus
Contract negotiations	WSMR	14-16 August	Maleck	S&ID, NASA
Quality control discussion	WSMR	14-16 August	Griffith-Jones	S&ID, NASA
Design status and requirements review	Tulsa, Oklahoma	14-16 August	Knoll, Ward, Nichols	S&ID, NAA-Tulsa
Subsystems testing	Metuchen, New Jersey	14-17 August	Kluth	S&ID, Applied Electronics
Configuration control meeting	WSMR	15 August	Robertson	S&ID, NASA
Hardware requirements meeting	Minneapolis, Minnesota	15-18 August	Guimont, Indelicato	S&ID, Control Data Corp.
Test facility	Aberdeen, Maryland	15-18 August	Jones	S&ID, Ballistics Research Laboratories

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